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The Uneven Hand of Uncle Sam in R&D Support

If some research fields have been suffering fiscal anemia, while others seem to be reasonably healthy, the reason, quite simply, is that federal spending for science in recent years has been characterized by a remarkable degree of disciplinary unevenness.

The table on page 2 did not receive the attention it deserves when it was released—in a blizzard of other official documentation—during last month's press briefings on the budget that Mr. Carter has submitted for Fiscal 1981 (SGR Vol. X, No. 2). But as can be seen from its presentation of the striking ups and downs that have occurred over the past dozen years, steadiness has played little part in federal funding of science. The field-by-field causes of these shifts vary from year to year, but there's enough persistence in the trends to outline some of the differences between the winners and the

losers. Which largely accounts for the remarkable fact of significant financial growth in a government agency that has been regarded by several administrations as over-financed. The big surges for cancer and heart research account for a lot of the growth, but it should be recalled that while the institutes concerned with these diseases have dominated NIH budget growth, the other institutes, after a Nixon-induced slowdown, put on a big growth spurt. For example, the budget of the National Institute of Arthritis, Metabolism, and Digestive Diseases was stuck around \$150 million a year from 1969 through 1974, when it took off to the point where its current budget is \$342 million. That figure is for present day paper dollars, but even so, the institute, like all its siblings in Bethesda, has fared reasonably well.

The decline in the growth of funds for basic research in psychology is mainly related to the ups and downs and confusions of the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), which, though a beneficiary of Mrs. Carter's keen interest in mental health and related matters, always remains a long way off from getting on with a stable program of

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Carter Aide Reveals Clashes In US-USSR Research Pact---Page 5

losers.

The category of "life sciences" refers almost exclusively to the basic-research spending of the National Institutes of Health, which exists in a political realm all its own. Though both the Nixon and Carter administrations tried to break the Congressional-Bethesda axis that has traditionally pumped budget-busting appropriations into NIH, the "real-growth" figure of 19 per cent provides firm evidence of which branch of government is in charge of biomedical budgetmaking. The principle of legislative dominance will be tested again in the NIH budget that Mr. Carter has submitted for Fiscal 1981, which begins next October 1. With the Cancer Institute listed for a mere \$7-million increase over its \$1-billion current budget, no one on Capitol Hill, in the White House or in Bethesda is even bothering to take serious note of that piddling figure; nor is much respect accorded the President's plans to boost the current total NIH budget—which amounts to \$3.582 billion—by a piddling \$139 million.

Despite the wailing that comes out of the scientific community in response to the belief that the American people have turned their backs on the promise of science, the fact is—as shown in a succession of polls—that health research is almost sacrosanct in the public's scale of spending priorities. What it all comes down to is that medical research has produced enough wonders to make the public eager for more and willing to pay for

In Brief

Under discussion between the National Cancer Institute and the Institute of Medicine, which conducts health-related studies for the National Academy of Sciences: An examination of the effects, medical and scientific, of the National Cancer Program, about which there is much controversy, but relatively little systematic information.

The Scientific Manpower Commission reports that in 1977, 1.1 per cent of all male PhDs were unable to find jobs; among women PhDs, the jobless totaled 4.7 per cent. Blacks totaled 6 per cent of freshman engineering students last year, compared to 2 per cent in 1970. Among MD recipients, Blacks increased from .2 per cent of the total in 1979 to 2.4 per cent in 1978.

John Deutch, who rapidly rose in the Department of Energy hierarchy during the reign of Secretary James R. Schlesinger, is stepping down from the post of Under Secretary, to return to MIT. Deutch is said to have had difficulty getting on with the batch of brass that DOE Secretary Charles Duncan brought along from the Defense Department.

Federal Basic Science Funds---Ups and Downs

(Obligations in Thousands of 1972 Dollars)

| Fields of Science | 1967 | 1980 | Real Growth 1967-80 |
|-------------------------------|------------------|------------------|------------------------|
| Total | 2,324,744 | 2,520,892 | + 8.4 |
| Life Sciences | 889,031 | 1,057,802 | + 19.0 |
| Psychology | 66,518 | 52,360 | - 21.3 |
| Physical Sciences | 750,369 | 649,182 | - 13.5 |
| Environmental Sciences | 263,424 | 352,134 | + 33.7 |
| Mathematics | 80,859 | 67,376 | - 16.7 |
| Engineering | 192,608 | 234,943 | + 22.0 |
| Social Sciences | 69,145 | 73,690 | + 6.5 |
| Other | 12,739 | 33,405 | + 162.2 |

NOTE: The GNP implicit price deflator was used for 1967 and an estimate of 9 percent (by OMB) used for 1980.

SOURCE: National Science Foundation

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fundamental research.

In the case of the physical sciences, down 13.5 per cent, the drop reflects the persistent decline—after having been up there for so long through the post-war period—of the physicists in the management of American research. The same people who used to advise the White House and Congress on nuclear-strategic matters also used to get an attentive hearing on what's needed for the health of American science. And, invariably, they would explain, in all good faith, that the country must spend plentifully on high-energy physics and other expensive fields of physical research, plus mathematics, which has also gone into a nosedive. The physicists lost their bastion in Washington when Nixon abolished the White House Office of Science and Technology and its council of elders, the President's Science Advisory Committee. The Office has been resurrected, but without the Committee; meanwhile, other national concerns and other Washington operators have come along to replace the aging cast that for so long managed to argue for the great needs of the physical sciences. The symbolic turning point occurred early in the Carter Administration when Robert R. Wilson, Director of the Fermi National Accelerator Laboratory, quit in a huff because Washington decreed a stretch-out of his con-

struction program.

The growth of environmental basic research is self-explanatory, given the wideranging concerns that exist about environmental purity. Engineering, up 22 per cent, benefits from the National Science Foundation's increased presence—at Congressional insistence—in the engineering sciences, plus the continuing return of the Defense Department as a source of support for academic research.

As for the social sciences, traditionally the stepchild of Washington's research-supporting agencies, the gain of 6.5 per cent in real purchasing power isn't much, but it could have been worse, given that Golden Fleece Proxmire has caused a lot of agency officials to be highly cautious about putting their money into anything that lends itself to ridicule. Since social-science research leads the pack in that regard, the pressures for growth have been encountering resistance. In addition, the social sciences, though present in most research-supporting agencies, have no distinct home of their own. While there's no lack of kind words for the value of social-science research—even allowing for Proxmire's cheap shots and the caution that this produces—there's also no concerted effort to pester Congress or to cultivate legislative champions for the social sciences. That the field grew at all in terms of federal financial support is a bit surprising.—DSG

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Plans from UN Vienna Conference Hit Snags

Serious difficulties have enveloped the two big initiatives associated with last summer's Vienna UN Conference on Science and Technology for Development: the US Institute for Scientific and Technological Cooperation (ISTC) and the proposed \$250-million UN fund to assist research related to economic development.

ISTC remains caught in a Congressional dispute over its relatively insignificant budget, while the UN fund is bogged down in squabbles over the size and composition of its staff.

Considering the magnitude of the problems that inspired the conference—starvation and illiteracy, to name just two—it is puzzling that seemingly unrelated political feuds could have such devastating effects on important international agreements. The truth is, however, that the problems facing both the UN fund and ISTC illustrate some of the basic difficulties confronting Third World assistance efforts.

Since it was created by Congress last year, ISTC has been embroiled in both political and financial disputes. Not only has it been accused by a Senate panel of illegal lobbying on its own behalf, but the new research agency—which legally exists, but without a budget—also has been caught in a crossfire of opposition to any increases in US foreign-assistance commitments. As a result of that opposition, the entire foreign-assistance appropriations bill, HR 4473, has been held up for several months in a House-Senate conference committee.

Because existing foreign-assistance programs are being carried along by a supplemental appropriations measure, the only hope for ISTC in the current fiscal year seems to be to attach itself to some more politically popular proposal. The most likely opportunity is for a proposal to assist America's new-found friends in Pakistan.

What seems ironic about all the effort that has gone into throttling the new-born ISTC is that its budget amounts to only about \$25 million in so-called new money, which is a mere drop in the enormous federal bucket. Whatever happens to ISTC, some \$60 million of its total \$90-million budget will continue to be spent by its parent organization, the International Development Cooperation Agency, successor to AID, which now has authority over many of the government's foreign research programs.

At issue in the dispute over ISTC is not how much money is spent but how it is controlled. Some early ISTC supporters, like Senator Adlai E. Stevenson (D-Ill.), envisioned that the agency would have a strong, independent governing board, largely free of economic or political pressures. Not only has Stevenson failed to get his way with this concept, but, he also may fail, if

the events of the past few months are any indication, to get any kind of organization that can coordinate the mass of US international R&D efforts now scattered throughout dozens of government agencies, academic institutions, and private foundations.

Sen. Dennis De Concini (D-Ariz.), who has been the leading opponent of ISTC, describes the new agency as just one more boondoggle in an already over-bloated foreign-assistance bureaucracy. His assessment seems to be winning friends.

Thomas Ehrlich, head of the International Development Cooperation Agency, pushed for support of ISTC in a recent address to the Council of Presidents of the National Association of State Universities and Land Grant Colleges.

"Foreign aid serves our economic and political interests," Ehrlich said.

The non-oil exporting developing countries are a major and the fastest-growing market for US goods. They already buy over one-third of our exports—the same share as for Europe and the Communist countries combined."

What's more, Ehrlich added, over a million US jobs now depend solely on exports to the developing world.

Even those American officials who recognize the importance of Third World investments often are reluctant to let the poor countries themselves decide how money for scientific and technological development should be spent. That seemed the crux of the problem facing the UN General Assembly when it began debating the proposed \$250-million fund in December.

Last-minute maneuvering at that session over the size and the status of the staff that would manage the \$250 million left the industrialized contributors, particularly the US, even less optimistic than they had been at the close of the summer conference.

At Vienna, the negotiators had agreed that an "interim" fund should be managed by existing UN mechanisms experienced in such matters. Only after careful study would a long-term science and technology financing system be created.

Arguing that they would not have enough say through the old system in how the fund would be dispensed, the bloc of 120 developing nations known as the Group of 77 pressed for their control of the money through a new UN system.

The arguments were not new but the fact that they reemerged at the General Assembly made some US officials begin to speculate last month that the US would not provide its full \$50-million share of the \$250-million fund over the next two years.

As it happens, President Carter requested only \$15

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France: Conflicting Schemes for Research

Paris. Preparations are underway here for the next five-year Development and Modernization Plan—the eighth in a postwar series of grand attempts to “indicate” rather than decree directions for this country. And, as might be expected in this period of agonizing over scientific priorities and resources, there is nothing simple or uncontroversial about the manner in which the research aspects of the Plan are to be considered.

The preparation of the Plan, which is under the direction of the Prime Minister, has previously utilized a Research Commission, representing union members, researchers, and scientific administrators, served by a secretariat furnished by the Secretary of State for Research. This time, however, Prime Minister Raymond Barre decided to scale down the role of the Commission to the point where it would be meaningless. The constituents of the aborted commission chose, however, not to accept this downgrading, particularly because of current efforts to revise the regulations that protect employment security for government scientists. What they got, after much agitation, was a new forum, parallel to the conventional planning process, but not quite a part of it. Since a name was deemed necessary for this new creation, it's been labeled the Committee on Research.

The maneuvering that led to the creation of this committee—as is the case with so much else in contemporary French science politics—is related to the intense antagonism that exists between Pierre Aigrain, the Secretary of State for Research, and Andre Giraud, the Minister for Industry. Aigrain, whose post is at the sub-cabinet level, is responsible for preparation of the annual budget for all civil research apart from telecommunications, as well

as for support of basic research; Aigrain commands a strong bureaucracy for this task, the *Delegation Générale à la Recherche Scientifique et Technique* (DGRST), which is akin to the White House science office. Giraud's aim is to deprive DGRST of its considerable power to allocate funds for industrial research and development, and reassign this authority to the individual ministries, which, in practical terms, means the Ministry of Industry and the Ministry of Agriculture.

With the two thus in opposition to each other, Giraud was quite pleased by the decision to drop the practice of having a research commission—staffed by Aigrain's office—participate in the preparation of the Plan. As for Aigrain, he does not have any high hopes for the substituted creation, the Committee on Research.

Last fall, President Valery Giscard d'Estaing made Aigrain responsible for the development of a 10-year research plan, the preparation of which is already underway, with the assistance of the DGRST staff and some 20 outside panels, which are scheduled to report in March. In addition, the 10-year project is also assisted by several specialized groups dealing with scientific subjects, plus some “thematic” groups, assigned to study and report on the relationship between technology and working conditions, the administration and financing of research, and so forth. Secretary of State for Research Aigrain quite naturally played a dominant role in selecting the personnel for these studies—which did not sit well with his old antagonist, Minister of Industry Giraud, who strongly supported the establishment of the Committee on Research, as a replacement for the former Commission on Research, for contributing to

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UN CONFERENCE

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million for the fund in his 1981 budget, which may be a sign of irritation at high levels.

At the January meeting of the American Association for the Advancement of Science, in San Francisco, Jean Wilkowsky, one of the US ambassadors at the Vienna meeting, warned that if disputes like the one in New York continued, US support would be increasingly difficult to obtain. Although she did not say the US would renege on its commitment altogether, she expressed her own impatience with the situation.

Although Ambassador Wilkowsky has retired since the Vienna meeting, the follow-up to the UN conference is being carried out by a new advisory panel on science and technology for development set up under the chairmanship of Thomas R. Pickering, Assistant Secretary

of State for Oceans and International Environmental and Scientific Affairs.

The panel has held only one meeting and will not meet again for another six months. Smaller groups, however, are being set up to discuss the problems of science and technology in foreign policy. One of the items that will surely be on their agenda is the March 1 pledging conference for the UN fund. Also likely to be on the agenda is the fate of ISTC.

Although Carter may have short-changed the UN fund in his 1981 budget figures, he substantially increased his request for the US research agency—from something under \$25 million in 1980 to \$95 million in 1981.

But, given the mood in Congress, he might just as well ask for \$1 billion.—Anne Roark

(The author is an Assistant Editor of *The Chronicle of Higher Education*.)

Press Tells of R&D Friction with Soviets

While detente was flourishing, US officials rarely uttered an unkind public word about how the Soviets were holding up their end of the extensive science and technology agreements that trace back to the Nixon-Brezhnev accords of 1972.

But now that it's all unraveling, what's coming into the open is that the Soviet-American branch of the brotherhood of science was experiencing some serious turbulence even before the Afghanistan and Sakharov affairs inspired a US pullback.

Testifying January 31 before a joint meeting of the House Subcommittee on Science, Research, and Technology and the Subcommittee on International Security and Scientific Affairs, Presidential Science Adviser Frank Press first sounded an upbeat note on the exchanges:

The flareup of international tension, he said, "comes at a time when the quality of Soviet participation in cooperative activities under the bilateral agreements had begun to improve in some ways. As the US has persisted in requiring mutual benefit and reciprocity of access, the tempo of joint activities in the last 12 months has increased in such areas as physics, electrometallurgy, fusion, and magnetohydrodynamics, subjects in which the Soviets have high levels of achievement. Exchanges in some of these areas," Press continued, "have taken years to develop and recently had begun to pay dividends."

Press then reported that the Soviets had been coming around on two of the most controversial aspects of cooperation—letting us meet their topflight people and also letting Jewish scientists take part in the collaborative efforts. On both points, he said, the Soviets had

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preparation of the Eighth Plan. Just as Aigrain "stacked" his study with his supporters, Giraud has sought to put his own people on the new Committee, starting with the chief of the Committee, who is an old schoolmate of his. The conflicts between the two groups are frequent and intense, and the situation is further complicated by the expectation, based on past experience, that Giscard d'Estaing will do as he pleases, without much reference to the voluminous reports that will emerge from these competing bureaucracies. Meanwhile, Prime Minister Barre, who must mediate between these two groups, has added to the confusion by asking a retired senior research administrator, Robert Chabbal—who was pushed out in the recent reforms of the

Following is a partial rundown of cutbacks that have been implemented or suggested in the research-cooperation field in response to recent Soviet nastiness:

- The Department of Energy has withheld shipment of a \$10-million chunk of apparatus designed and built in the US for the Soviet magnetohydrodynamics (MHD) facility near Moscow.
- The White House has decreed that high-level US officials are to shun science- and health-related bi-lateral contacts with Soviet counterparts; working-level meetings of government employes are okay, as are contacts of a humanitarian nature, plus those that, for whatever reason, the US finds it advantageous to pursue, even in present circumstances.
- The 5000-member Federation of American Scientists, citing its spiritual affinity with Sakharov—whose political awakening, like that of the FAS, was in anti-bomb sentiments—has announced that it's "adopting" the Soviet physicist. FAS has also called on individual scientists to break off contacts with Soviet colleagues. FAS Director Jeremy Stone suggested that this be done individually, rather than on an organizational basis, to convey to the Soviets that the pullback has grass-roots support.
- Rep. George Brown (D-Calif.), chairman of the House Subcommittee on Science, Research, and Technology, has introduced legislation for a one-year moratorium on Soviet-American scientific exchanges. The bill is destined to go no place, but since Brown is a reasonably level-headed legislator, the fact that he introduced this vaguely worded measure provides some idea of current Washington sentiment.

Centre National de la Recherche Scientifique (SGR Vol. IX, No. 17)—to prepare a report on budgeting procedures for research.

The major point of agreement between the Aigrain and Giraud groups is that France must increase its research and development expenditures, from the present 1.8 per cent to about 2.2 per cent of gross national product—which is the current figure for the US and West Germany. The main question is how quickly this should be done—in five or 10 years?

But, given the sluggish nature of great segments of French industry, there is no doubt here that France must invest more heavily in R&D if it is to meet the industrial challenge of Japan, and to a lesser degree, of Germany. The Aigrain and the Giraud camps agree on little else, but on that point, they are in harmony.—FS

Innovation Studies: Available Reports Listed

With interest in industrial innovation currently running high, we'd like to bring attention to a flock of recent reports on this topic currently available from the Industrial Research Institute Research Corporation: Address orders to: IRI/RC, 7800 Bonhomme Ave., St. Louis, Mo. 63105; tel: (314) 725-2662:

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"A STUDY OF THE SUPPORT OF BASIC RESEARCH BY INDUSTRY"; (with Rensselaer Polytechnic Institute) NSF-C76-21517; 1973, no charge.

Based on a questionnaire to all I.R.I. member companies, and to a selected list of non-member, high-technology companies, followed by personal interviews with a selected group of R&D executives, both the extent of industrial support of basic research and the reasons for support or non-support were determined. The interviews also examined forces influencing the allocation of R&D resources in industry today.

"TECHNOLOGICAL INNOVATION: A CRITICAL REVIEW OF CURRENT KNOWLEDGE"; (W. E. Hanford, Principal Investigator) NSF 76-SP-1180, January 1978. (Executive Summary, no charge. Full report, \$25 I.R.I. members/\$50 non-members).

The five-volume Georgia Tech study was brought up to date as of the end of 1977 and an Executive Summary, both of the original report and of subsequent literature, was prepared.

The incremental literature search, including abstracts, which comprises Volume II of the study, totals 303 pages. The index, covering published literature both in the Georgia Tech study and in the up-date, comprises Volume III and totals 102 pages.

"CONTRIBUTIONS OF BASIC RESEARCH TO RECENT SUCCESSFUL INDUSTRIAL INNOVATIONS"; (W. Conard Fernelius, Principal Investigator) NSF 77-17908; May 1979. (Executive Summary, no charge. Full report, \$12.50 I.R.I. members/\$25 non-members).

A series of case histories have been developed and analyzed illustrating the effect of basic research completed since 1945 on industrial innovations successfully commercialized since 1965. Salient features and the relative effect of them on successful innovation are discussed.

"TRENDS IN INDUSTRIAL RESEARCH"; (George E. Manners, Jr. and Howard K. Nason) 78-SP-0631; April 1978, no charge.

EXCHANGES (Continued from Page 5)

been budging, so that "younger and more able Soviet scientists—including Jewish scientists—had recently been allowed to participate in direct, longer-term exchanges between the National Academy of Sciences and the Academy of Sciences of the USSR."

Then the President's Science Adviser turned to the rough and previously unpublicized part of Soviet-American scientific and technical collaboration.

"In some other ways," he said, "Soviet performance has not been satisfactory. Because of the closed nature of their society, it has been difficult for them to cooperate in certain ways that appear normal to us but which to them apparently are inconsistent with the principles of state planning and control.

"For example, under the Transportation [research]

Using perceptions developed under the "Basic Research by Industry" project, a paper was prepared for the National Science Board and published in their NSB-78-191, "Planning Environment Review 1978". The paper summarizes the status of research in industry as of mid-1978, and discusses forces affecting allocation of R&D resources by industry.

"INDUSTRY ASSESSMENT OF U.S.D.A. POST-HARVEST TECHNOLOGY RESEARCH"; (R. W. Cairns, Principal Investigator) U.S.D.A. 53-32R6-8-005, August 1978. (\$5 I.R.I. members/\$10 non-members).

A group of emeritus members and other selected industry retirees evaluated the programs and plans with special reference to the question, "Should and would industry support such research with its own funds if Government did not fund them?" The report concludes, in part, "Research on agriculture crop utilization should not be curtailed at present. In view of the size of the present PHT research, a modest expansion is suggested—, particularly along lines of improved human nutrition and safety". Suggestions were made with respect to specific programs and areas of investigation, and for eliciting more industrial input to program planning.

"SOLAR HEAT FOR PROCESSING OF FUELS AND CHEMICALS"; (Howard K. Nason, Principal Investigator) California Tech. J.P.L. 95196 under NASA NAS7-100 Task Order RD-152, May 1979. No charge.

Industrial input was requested to plan a long-range research project on the application of solar heat in the processing of fuels and chemicals. I.R.I. emeritus members conducted interviews with selected companies to obtain their suggestions for this program.

"A SURVEY OF INDUSTRIAL INPUT TO R&D PLANNING FOR USE OF HIGH-TEMPERATURE SOLAR ENERGY IN CHEMICALS AND FUELS PROCESSING"; (Howard K. Nason). Paper presented at the Session on Solar Fuels and Chemicals, Semi-Annual Review of Advanced Solar Power Systems, Long Beach, CA, June 1979. (Summarizes findings of the above study. No charge).

"COOPERATIVE TECHNOLOGY PROGRAM; EVALUATION OF NINE CANDIDATE AREAS FOR INDUSTRY PARTICIPATION AND SUPPORT"; (Hamilton Herman, Principal Investigator) U.S. Dept. of Commerce NB79-SBCA0039. (Executive Summary, no charge. Full report \$25).

A task force of emeritus members and other industry experts ex-
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Agreement, the Soviet side repeatedly refused to fulfill commitments to permit access to ice-transiting technology. Cooperation in this area apparently was considered too sensitive by Soviet naval authorities. As a result, the United States cut off any further cooperation in that area and agreed to a two-year renewal of the agreement instead of the previous five.

"Under the Energy Agreement," Press continued, "the Soviets agreed last June to exchange information on energy production and use for the next 20 years on a regional basis, but failed to carry through. Cooperation of this type was apparently considered too sensitive by planning authorities. As a result, the United States dropped further cooperation in two areas, solar and thermal energy, and further steps will be taken. Thus," Press pointed out, "not all cutbacks have been motivated by foreign policy."

INNOVATION (Continued from Page 6)

plored the desirability and feasibility of establishing cooperative technology programs with industries concerned, trade associations and other interested parties. The Cooperative Technology Act passed by the last Congress provides the framework and funding for the program, implementation of which is assigned to the Dept. of Commerce.

The areas chosen for initial activity were: Textile; Welding and Joining; Coatings; Corrosion; Semiconductors; Flexible Manufacturing (including Robotics and Light Machinery); Powder Metallurgy; Radiation Processing; Composites.

"POLICIES FOR FUNDING AND BUDGETING OF CORPORATE RESEARCH PROGRAMS: A STUDY OF SIXTEEN I.R.I. MEMBER COMPANIES"; (W. T. Hanson, Principal Investigator), Sponsor, Exxon R&E Co., May 1979, no charge.

A quick study revealed perceptions of corporate research apparently typical of large I.R.I. member firms.

"A STUDY OF ENERGY R&D IN THE PRIVATE SECTOR"; (Rensselaer Polytechnic Institute and Dept. of Energy EX-77-C-01-6089). (Executive Summary, no charge). A limited number of copies of the complete report is available from the Dept. of Energy. When this supply is exhausted, additional copies will be available from I.R.I. Research Corporation \$50/copy.

"AMERICAN PERCEPTIONS OF BARRIERS TO INNOVATION", National Science Foundation, Seminar on Technological Innovation, held in Bonn, Germany, April 1976, co-sponsored by NSF and Bundesministerium für Forschung und Technologie, Federal Republic of Germany, published as Chapter 2.5 in "Innovation, Economic Change and Technology Policies", Karl A. Stroetmann, Editor, Birkhäuser Verlag, 1977, pp. 159-166. An edited version also published in *Research Management*, Vol. 20, No. 1, pp. 17-20, January 1977. No charge.

"THE EFFECT OF GOVERNMENT REGULATION ON INNOVATION IN THE CHEMICAL INDUSTRY", Arthur A. Gerstenfeld, Worcester Polytechnic Institute, and Howard K. Nason.

Paper presented at the Symposium on the Effects of Government Regulation on Innovation in the Chemical Industry, sponsored by American Chemical Society, Division of Industrial and Engineering Chemistry, Miami, September 1978. Published in ACS Symposium, Series No. 105, American Chemical Society, Washington, 1979. No charge.

"THE ENVIRONMENT FOR INDUSTRIAL INNOVATION IN THE UNITED STATES".

Conference on Government/Industry Cooperation for Technological Innovation, Sponsored by the National Science Foundation, Division of International Programs, at Geneva, Switzerland, June 1977. Published as Chapter 7 in *Technological Innovation: Government/Industry Cooperation*. Arthur Gerstenfeld, editor, John Wiley & Sons, 1979. An edited version was published in *ASM News*, Col. 8, No. 10, pp. 4-6, October 1977. No charge.

"REGULATION AND INNOVATION — SYMBIOTES OR ANTI-THETS?", George E. Manners, Jr., Rensselaer Polytechnic Institute and Howard K. Nason.

Paper prepared for presentation at Conference on Government Regulation and Technological Innovation, Delft, the Netherlands, June 1979, sponsored by National Science Foundation. No charge.

"RISK, UNCERTAINTY AND INNOVATION IN INDUSTRY", Howard K. Nason.

Discussion paper presented at Thirty-Third National Conference on the Advancement of Research, Hershey, PA, October 1979. No charge.

"POLICIES FOR FUNDING & BUDGETING CAPITAL EXPENDITURES FOR EQUIPMENT AND R&D FACILITIES". (W. T. Hanson, Principal Investigator)

A study of twenty I.R.I. member companies, sponsored by Hercules, Inc. (Development Department). No charge.

"DISTINCTIONS BETWEEN BASIC AND APPLIED RESEARCH—AN INDUSTRIAL PERSPECTIVE", Howard K. Nason.

Discussion paper presented at Seminar on Distinctions Between Basic and Applied Research, sponsored by National Science Foundation, Washington, DC, December 1979. No charge.

"ENERGY SUPPLY STRATEGY: GETTING TECHNOLOGY COMMERCIALIZED. SHALE OIL AND ENHANCED OIL RECOVERY". Rensselaer Polytechnic Institute with I.R.I. Research Corporation and A. D. Little, Inc. DOE EJ-78-S-02-4973. September 1979. (Executive Summary, no charge. Full Report \$10).

Expanded Sino-US Science Ties

While US ties with Soviet science are steadily eroding, closer relations with the reawakening scientific community of the People's Republic of China continue to develop.

The latest manifestation of this trend is an announcement from the US National Academy of Sciences setting forth additional areas for scientific cooperation between the two countries. These cover a variety of scientific and technical fields, some now ripe for collaborative efforts, such as earthquake research—in which the Chinese have long been interested. Others must await the rebuilding of China's scientific establishment.

The announcement of new interests between the two countries followed a visit to Peking in January by a US scientific delegation.

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A Contrary View on Cutting Soviet R&D Ties

With both government and non-government scientists harmonizing that we've got to chop research collaboration with the Soviets in retaliation for the Afghanistan invasion and the internal exile of Andrei Sakharov, it's important to register a rare dissent on this proposition. It comes Victor F. Weisskopf, MIT Professor of Physics, a longtime leader in international research cooperation, Weisskopf made the following points in testimony January 31 at a House hearing presided over by Rep. George Brown (D-Calif.):

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I would like to recommend the maintenance of . . . formal scientific relations with the Soviet Union. I am against breaking or restricting the presently existing official agreements [though individual participation] should be left to the judgment of the individual, as it has been in the past.

First . . . there is a difference between scientific collaboration and holding the Olympic games in the Soviet Union . . . Scientific meetings or collaborative efforts . . . hardly get any publicity and they do not lend themselves to any kind of national propaganda. Second, it is important to realize that the scientific community in the Soviet Union contains people who are inclined to condemn provocative military action and racial discrimination; they have a great deal of hidden (sometimes not so hidden) sympathy for the dissidents and, in particular, for Sakharov. This relatively lenient treatment of Sakharov may have been more to placate his internal supporters in the scientific community than his foreign friends. I am referring to those scientists who have participated in the USA-Soviet collaboration; they mostly

are engaged in basic science or in non-military applied research. To my knowledge, there is a much stricter separation in the Soviet Union between those who work on weapons development and those engaged in basic science. The former group may represent a different political spectrum and are rarely involved with meetings or other collaborative efforts.

Third, the scientific collaboration does not give any immediate support or advantages to the industrial or military potential of the Soviet Union. This is so because the results of basic science have their effects on practical applications, at best, a few decades later. . .

I believe that it is important that the United States uphold the principle that science belongs to all humanity and stands above the vagaries of political strife. It should serve, and has served in the past, as a bridge for mutual understanding and peace in a divided world.

We should not lose contact with one of the best elements of Soviet society, with a group which basically agrees with our value scale and—in contrast with the avowed dissidents—who may have a significant influence on the future developments in the Soviet Union. If, as we hope, the present spirit will not lead to a catastrophe, there is a chance that, sooner or later, the character of the Soviet regime may change again for the better. We ought to invest some capital in this possibility. Scientific relations are most suitable for this investment since their maintenance does not strengthen the Soviet potential to any serious extent, but it strengthens the idea of the supra-national character of science and mutual understanding. It leaves open the possibility for discussion of political issues even during times of stress, as the Pugwash movement has shown in the past.

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